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The Common Bird Composition, Abundance and Distribution in the Most Developed and Industrialized Provinces of Turkey

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ABSTRACT

Turkey is an industrializing and developing country. Overall, 71% of industrial activities of Turkey occur in twelve provinces. The main aim of this study was to determine the composition, abundance and distribution of common species in these provinces. The data sources used here are observation that recorded between 1946 and 2017 achieved from KuşBank database, personal observation notes and published literature. According to the findings, the most common ten bird species in those provinces; The house sparrow *(Passer domesticus)*, the Eurasian magpie *(Pica pica)*, the hooded crow *(Corvus cornix)*, the great tit (*Parus major*), the yellow-legged gull (*Larus michahellis*), the common chaffinch (*Fringilla coelebs*), the blackbird (*Turdus merula*), the Eurasian coot (*Fulica atra*), the barn swallow (*Hirundo rustica*) and the Eurasian jackdaw (*Corvus monedula*). Regional differences have been detected in the composition, abundance, and distribution of common species. The composition of species in these provinces has changed within years. Especially the distribution area, and dominance of the Eurasian magpie has increased. In the near future, it is expected that there will be new changes in the composition, distribution, and dominance of common species due to the increase of industrialization and urbanization.

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Türkiye'nin En Gelişmiş ve Sanayileşmiş İllerindeki Yaygın Kuş Kompozisyonu, Bolluğu ve Dağılımı

ÖZET

Türkiye sanayileşmekte ve gelişmekte olan bir ülkedir. Türkiye'nin sanayi faaliyetlerinin %71'i on iki ilde gerçekleşmektedir. Bu çalışmanın temel amacı, bu illerdeki yaygın türlerinin kompozisyonu, bolluğu ve dağılımını belirlemektir. Burada kullanılan veri kaynakları; KuşBank veri tabanında 1946 ve 2017 yılları arasında arşivlenmiş olan gözlem kayıtları, kişisel gözlem notları ve yayınlanmış literatürden elde edilen gözlem kayıtlarıdır. Bulgulara göre, bu illerdeki en yaygın on kuş türü: ev serçesi (*Passer domesticus*), saksağan (*Pica pica*), leş kargası (*Corvus cornix*), büyük baştankara (*Parus major*), gümüş martı (*Larus michahellis*), ispinoz (*Fringilla coelebs*), karatavuk (*Turdus merula*), sakarmeke (*Fulica atra*), kır kırlangıcı (*Hirundo rustica*) ve küçük karga (*Corvus monedula*)'dır. Yaygın türlerin kompozisyonu, bolluğu ve dağılımında bölgesel farklılıklar tespit edilmiştir. Bu illerdeki türlerin kompozisyonu yıllar içinde değişmiştir. Özellikle Saksağan'ın dağılım alanı ve baskınlığı artmıştır. Yakın gelecekte sanayileşmenin ve kentleşmenin artması nedeniyle yaygın türlerin kompozisyonu, dağılımı ve baskınlığında yeni değişimlerin yaşanması beklenmektedir

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INTRODUCTION

Turkey is divided into seven geographical regions according to climate, location, flora, fauna, human habitat, agricultural diversities, transportation, and topography. Four regions were named after the seas bordering them - the Aegean Region, the Black Sea Region, the Marmara Region and the Mediterranean Region. The three other regions were named in accordance with their location in the Anatolian peninsula - Central, Eastern and South Eastern Anatolia Regions. According to the development levels of these geographical regions, the order from the most developed to the least developed is as follows; Marmara, Aegean, Central Anatolian, Mediterranean, Black Sea, South Eastern Anatolia and Eastern Anatolia (Karcı et al., 2014).

Turkey, located on Anatolian peninsula (Asia Minor) and Thrace lands (European Turkey), has eighty-one provinces. Turkey's rapid urbanization has changed the country demographically and economically. Urban population rate increased from 25% in the 1950s to 75% in 2015. Provinces have more than 75 percent of the country's population and contribute significantly to the competitive economy in terms of the industry today. Turkey's economy share rose to 27 percent from 17.6 percent at the country's rapid urbanization period between 1960 and 2013 (World Bank, 2015). Turkey is being industrialized and developing country. Overall, 71% of industrial activities occur in twelve provinces, namely: İstanbul, Bursa, Ankara, İzmir, Konya, Gaziantep, Denizli, Kocaeli, Adana, Tekirdağ, Kayseri, and Mersin (Sanayi Genel Müdürlüğü, 2014).

A small number of species typically constitute the vast majority of individuals in any ecological community (the most abundant 25% of species usually comprise >90% of all individuals). For this reason, common species are disproportionately important for the functioning and ecosystem processes and service delivery of terrestrial and marine ecosystems just because of the numbers. They are also the main victims of habitat losses, ecosystem deterioration, and over-employment, and often suffer losses in population and distribution. However, despite their abundance, these species did not receive much attention from ecologists and conservation biologists (Gaston, 2010, 2011). The commonest birds are the most numerous. Therefore, their decreases have an impact on the ecosystem functions and services which they provide in Europe (Inger et al., 2015).

The Turkish avifauna consists of the 483-bird species which have occurred in Turkey (available online at http://www.trakus.org/)). According to the IUCN criteria; 35 bird species are under threat at the European scale in Turkey (BirdLife, 2015). 120 species (the most abundant 25% of species) are common in Turkey. Few studies have been made about the common birds in Turkey. The common swift (Per and Çağlayan, 2005) and the White stork census had been carried out in Turkey between 2004 – 2005. The Pan-European Common Bird Monitoring Scheme (PECBMS) had been carried out in Turkey between 2007 – 2008.

The main aim of this study was to determine the composition, abundance, and dominance of the most common species by providing a local basis database in these developed and industrialized twelve provinces. The relative similarity and difference are expected in species composition and distribution with regard to the geographical regions of these provinces.

In particular, were examined the following questions:

- How does the abundance of these birds change in these provinces?
- Do these species have the regional and yearly difference in distribution and composition?
- What are the major factors for their dominance in provinces?

To answer these questions a database was established.

MATERIAL and METHODS

Historical data gathered from observation records between 1946 and 2017 achieved from observation databases (KuşBank, 2017; Trakuş, 2017) personal observation notes and published literature were used (Roselaar 1995; Per et al., 2002; Aksan et al., 2004; Per and Aktaş 2008). The most developed and industrialized twelve provinces in Turkey: İstanbul, Bursa, Ankara, İzmir, Konya, Gaziantep, Denizli, Kocaeli, Adana, Tekirdağ, Kayseri and Mersin (Figure 1). 2.620 different point records of the most common ten species were used for this research. Bird records from these provinces were analyzed to determine the most common ten species. The differences between provinces were analyzed comparatively. Distribution maps for each bird species were made. Dots are records of the species. The relative abundance and frequency were calculated in each province. Clustering analysis was done to find similarities of provinces in terms of common species composition. This analysis was performed using R software (Maechler et al., 2013).

RESULTS and DISCUSSION

According to findings between 1946-2017, the most common ten bird species in those provinces are The House sparrow *(Passer domesticus)*, The Eurasian magpie *(Pica pica)*, The Hooded crow *(Corvus cornix)*, the Great tit (*Parus major*), the Yellow-legged gull (*Larus michahellis*), the Common chaffinch (*Fringilla coelebs*), the Blackbird (*Turdus merula*), the Eurasian coot (*Fulica atra*), the Barn swallow (*Hirundo rustica*) and the Eurasian jackdaw (*Corvus monedula*) These species records were all noted on more than 25% of the total observations (Figure 2).

Periodic differences have been detected in the composition and abundance of common species. The

Ruddy shelduck (*Tadorna ferruginea*), the common redshank (*Tringa totanus*) and the gray heron (*Ardea cinerea*) dominant before 1970. The abundance and composition of the most common three species changed between 1970 – 1989 with The White stork (*Ciconia ciconia*) and the house sparrow (Figure 3).

Figure 1. Map of the study area in Turkey

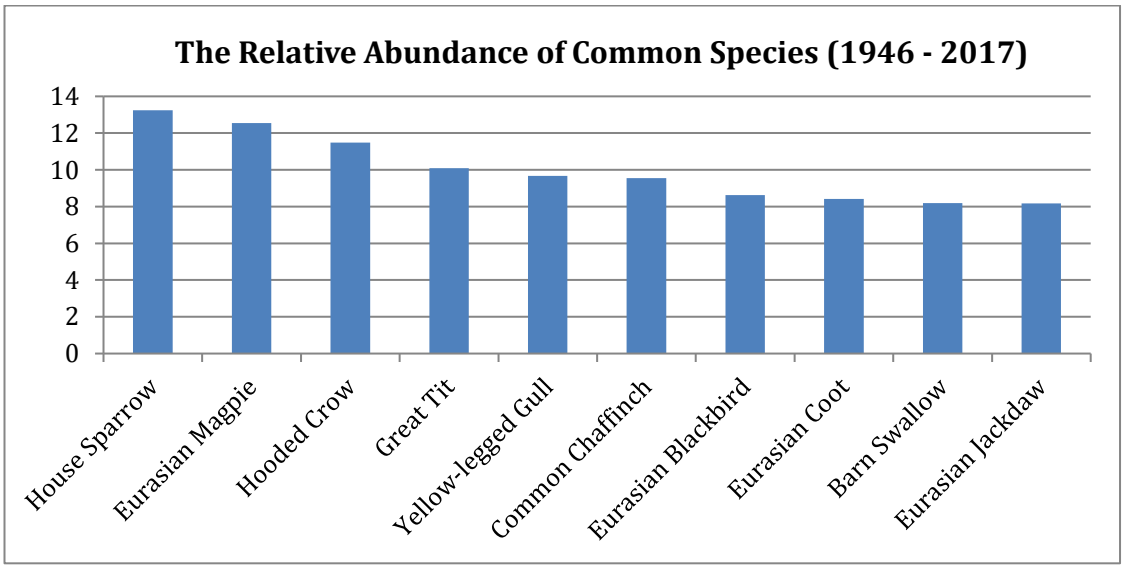

Figure 2. The most common ten species between 1946 and 2017

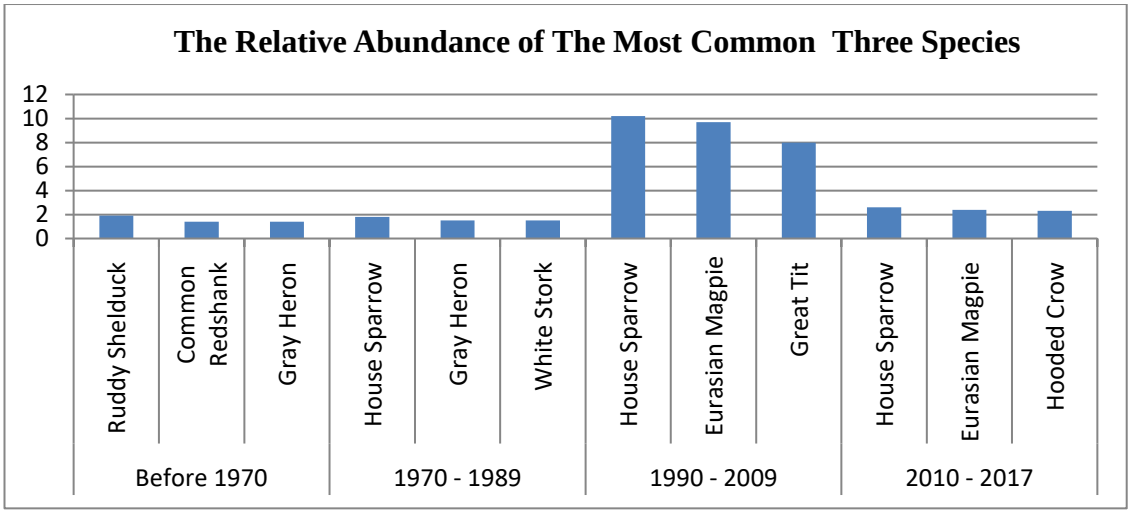

Figure 3. The most Common three species and yearly periods

The House sparrow is the most common species between 1970-2017. It followed by the Eurasian magpie.

Box plots showing frequency of the occurrence of common bird records in industrialized provinces. It shows the median (heavy line), quartiles (box), 10 and 90 percentiles (bars), and 5 and 95 percentiles (whiskers). The Eurasian magpie, the yellow legged gull, the blackbird and the Eurasian jackdaw are showing symmetric distribution at the boxplot graphic. The House sparrow, the hooded crow, the great tit and the barn swallow are show asymmetric distribution which is skewed to the right. The Eurasian coot is showing asymmetric distribution which is skewed to the left. The highest frequency was found in the house sparrow and the Eurasian magpie species (Figure 4).

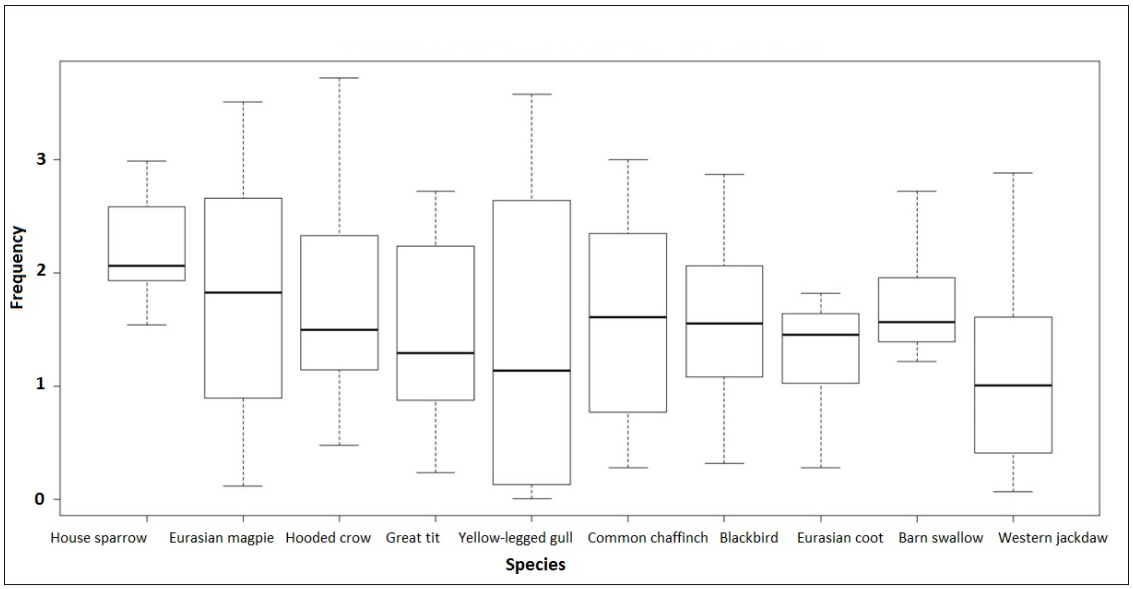

Figure 4. Frequency of the occurrence of common bird records in industrialized provinces

Regional differences have been detected in the composition, abundance, and distribution of common species. The white-spectacled bulbul (*Pycnonotus xanthopygos*) is dominant in Adana and Mersin (Mediterranean); the Eurasian collared dove (*Streptopelia decaocto*), the European goldfinch (*Carduelis carduelis*) and the Crested lark (*Galerida cristata*) are dominant in Adana, Bursa, Denizli, Gaziantep, İzmir, and Mersin (Aegean, Marmara and Mediterranean); the Great cormorant (*Phalacrocorax carbo*) is dominant in İstanbul, İzmir, and Kocaeli (Aegean and Marmara); the Rock dove (*Columba livia*) is dominant in Kayseri and Ankara (Central Anatolian) (Figure 5).

The dendrogram was produced for common birds by hierarchical clustering analysis using complete linkage measure. Four clusters were derived from this analysis for twelve provinces. Tekirdağ is grouped unique, İstanbul, Kocaeli, Bursa and İzmir; Gaziantep, Adana and Mersin; Ankara, Denizli, Kayseri, and Konya are grouped together (Figure 6).

The species composition in these provinces has changed within years. The relative abundance was calculated for each province. Especially the distribution area and dominance of the Eurasian magpie has increased (Figure 7).

People dominate the earth's ecosystems in various ways. Important changes occur in the ecosystems with human effect. One of the most striking and permanent is the change of the land-cover (Marzluff, 2001). Human populations are growing and continue to dominate ecosystems in most of the world (Vitousek et al., 1997). The level of urbanization is expected to increase in all the major developing regions of the world over the next decades (UN, 2013). Most urban growth is happening in developing countries where human population is increasing at an exponential rate (WRI, 1996). Urban areas characterized by high building density often have mostly industrial or commercial development (Marzluff et al., 2002). Turkey is an industrializing and developing country with high population growth rate (UN, 2012). Industrial zones began to emerge in certain areas in parallel with the process of industrialization in Turkey. Transport facilities, proximity to markets and other networks have been the determining factors in establishing the industrial areas in the Marmara basin, coastal Aegean, the eastern Mediterranean and the capital Ankara (Cansız, 2010).

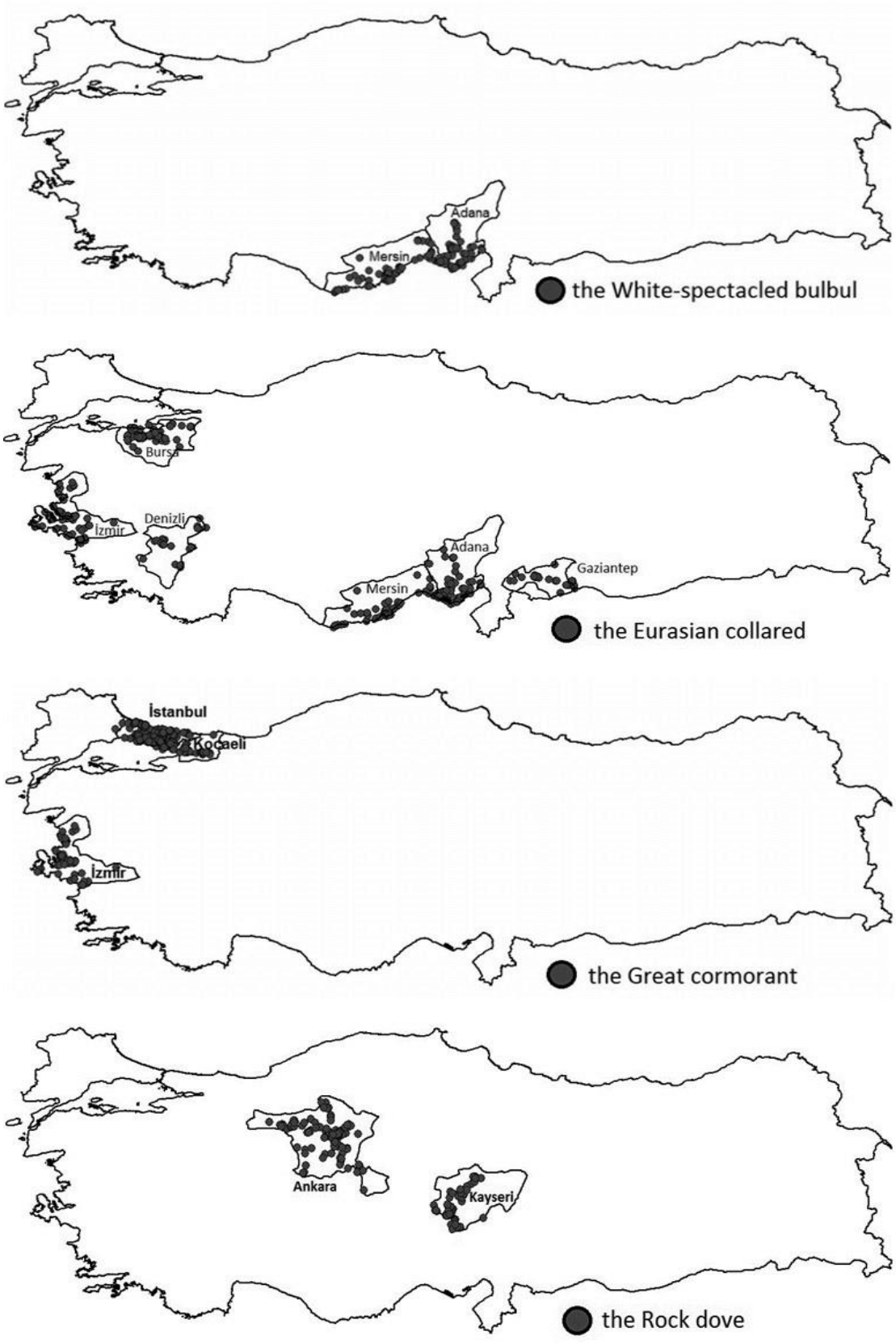

Figure 5. Distribution maps of the most dominant species in different provinces

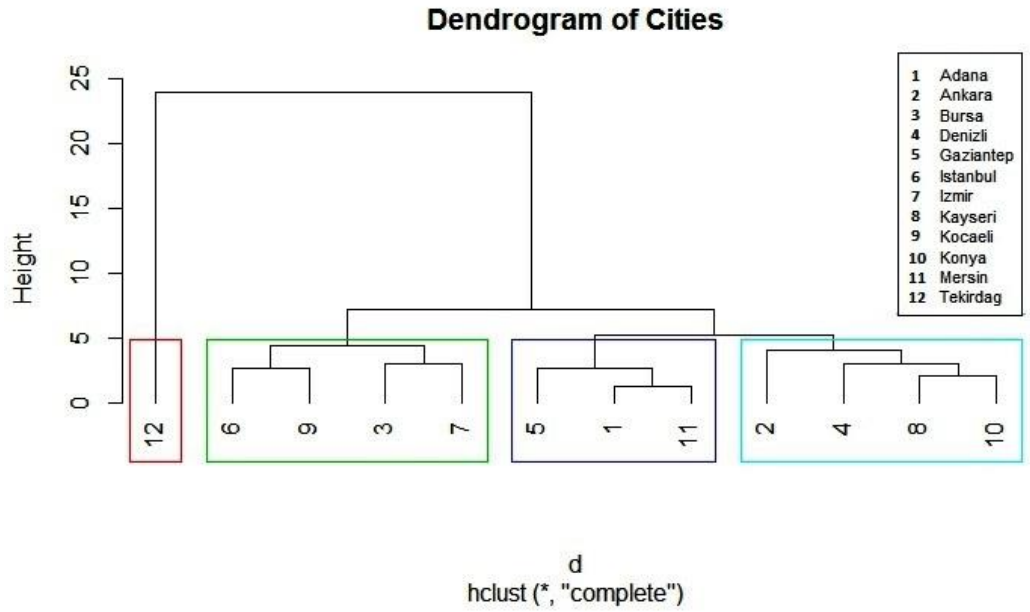

Figure 6. The dendrogram from a hierarchical cluster analysis with complete linkage

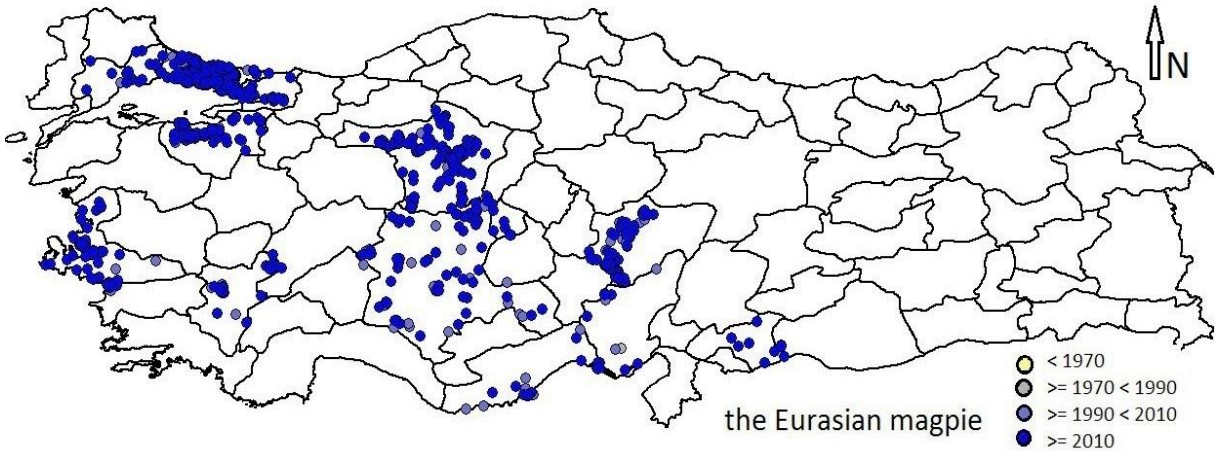

Figure 7. Distribution map of the Eurasian magpie between different years in different provinces

71% of industrial activities in Turkey are being occurred in twelve provinces; Marmara (Bursa, İstanbul, Kocaeli, Tekirdağ), Aegean (Denizli, İzmir), Central Anatolian (Ankara, Kayseri, Konya), Mediterranean (Adana, Mersin) and South Eastern Anatolia (Gaziantep) regions. The industrialization is very different on the provincial level. The Black Sea and Eastern Anatolia are less developed regions and they have not got very industrialized provinces. Their climate, location, flora and fauna, human habitat, agricultural diversities, transportation, and topography are limiting factors.

According to a global assessment conducted in 54 cities, the most common species are namely; the rock dove (51 cities); the House sparrow (48 cities), the European starling (44 cities) and the barn swallow (43 cities) (Aronson et al., 2014). According to a national study conducted in 6 provinces between 2007 - 2008, the most common species are namely; the house Sparrow, the barn swallow, the crested lark, the blackbird, the Eurasian magpie (Balkız et al., 2008). According to findings, the most common bird species in these provinces are the house sparrow, the Eurasian magpie, the hooded crow, the great tit, the yellow-legged gull, the common chaffinch, the blackbird, the Eurasian coot, the barn swallow and the Eurasian jackdaw.

Urban ecosystems develop in time and space as a result of the dynamic interaction between socio-economic and biophysical processes (Alberti and Marzluff, 2004). Human activity and urbanization lead to more homogeneous biotic communities. Urbanization, in particular, causes some species to become invasive. This results in more homogeneous

faunal assemblages (Blair, 2001). When the results of the most common three species with yearly period are compared, they are very different from each other. Most of the observations before 1970 belong to the mid-winter waterbird counts. The Ruddy Shelduck was the most common species at this period. Individual bird watching data and mid-winter bird counts increased between 1970 and 1989. The House sparrow and the gray heron are common species at this period. The number of bird watchers, photographers and observations increased between 1990 and 2017. The House sparrow, the Eurasian magpie, and the hooded crow are common species at this period. Data show very unevenly distribution for the period up to the 1990's. Because most of the observations belong to the mid-winter waterbird census. At the same time, birdwatchers generally recorded "interesting" bird species and neglected widespread and abundant ones in this period. After 1990, homogeneity increased in common species composition in Turkey.

Bird watching data increased rapidly after the initiation of KuşBank (An İnternet Based Citizen Science Project for Bird Conservation) in 2004 (Özesmi and Per, 2006). The number of bird observations and the number of bird watchers are increasing every year in Turkey. The common species has got the high ecological tolerance. With the effect of both factors, new records were obtained from different places.

Cluster analysis is designed to group similar items in the database. Hierarchical cluster methods create a hierarchy of clusters from small clusters of very similar items to large clusters that include more dissimilar items Ankara (Holland, 2006). According to the clustering analysis, the composition of common species in industrialized provinces shows a difference geographically. This is a concrete indication that the provinces in the same geographical region are usually gathered in the same clusters. Only Tekirdağ is different. The number of observations belonging to Tekirdağ is low and the records are irregular. For this reason, Tekirdağ has been clustered with a different composition and abundance from the second cluster (İstanbul, Kocaeli, Bursa) located in the same geographical region.

Species composition, relative abundance and distribution of the bird fauna of Lake Tana, in Infranz, Ethiopia were evaluated in another research. A total of 129 bird species were identified. The species composition of birds during the wet and dry seasons was not shows significantly difference (Aynalem and Bekele, 2008). The species composition in this study has changed within years but the species composition of common birds in different provinces in the four seasons was not shown significant difference except the Barn swallow (*Hirundo rustica*) that to be migratory species in Turkey. The Barn swallow is an attractive migrant bird species for bird watchers. Its records are increasing especially in the spring term.

The Eurasian coot is a widespread breeder in most parts of Europe. Its breeding population trend is stable in Turkey (Birdlife, 2004). According to this research and mid-winter bird counts, the Eurasian coot is the commonest and dominant species in wetlands in Turkey.

The House sparrow is the best-known bird species among the people in Turkey. It is the commonest species in Turkey. The European population is declining (De Laet and Summers-Smith, 2007). Observation records show fluctuations in Turkey.

The most important factors in determining the distribution of the white-spectacled bulbul were geographic and climatic (Aslan, 2005). The white-spectacled bulbul is spread and dominant in the Mediterranean region (Mersin and Adana). Especially coastal habitat is important for its distribution.

The Eurasian collared dove was introduced in Turkey and the Balkans during the 16th century. Its native range is India. It prefers suburbs, towns, and agricultural settlements, city centers, countryside, and forested areas in Western Europe. This species survives by feeding with grain, usually indirectly from human (Smith, 1987). Habitat and climate have significant impacts on population growth rates and the carrying capacities of this species (Scheidt and Hurlbert, 2014). This species is dominant and its population is increasing in Adana, Mersin (South coast), İzmir (West coast), Bursa (North coast), Gaziantep (Steppe and semi-desert). These provinces have suitable climatic conditions and feeding habitat in four seasons for this species.

The European goldfinch is resident in a large part of Europe. It is native species and the population is stable in Turkey (Birdlife, 2004). It lives in orchards, seed-heads of thistles, other tall plants (Heinzel et al., 1992), low-lying deciduous woodland and pine plantations (Svensson, Mullarney, and Zetterstrom, 2009). The crested lark is native in Turkey (Birdlife 2004). This species lives in sparse vegetation, arid areas, and the plains. Urbanization, industrialization, deforestation and climate change negatively affect this species (De Juana et al., Suárez, 2004). Population trend shows the moderate decline in Europe (Gregory et al., 2007). The European goldfinch and the crested lark were dominant in Adana, Bursa, Denizli, Gaziantep, İzmir, and Mersin. These provinces have suitable feeding habitat in four seasons for this species. There is no research about population trends in Turkey.

The Great cormorant is distributed in a large part of Europe. It is native in Turkey (Birdlife, 2004). It is one of the common bird species in Mid-Winter Water Bird Counts in Turkey. It is dominant in İstanbul, İzmir,

and Kocaeli. This species is observed in inland wetlands and in pier around urban areas by citizens in Turkey.

The Rock dove is a resident species which is widely distributed in most parts of Europe (except for the far north) (Birdlife, 2004). It is the native species to most parts of Europe that were introduced to the world as a food source or game. It is native in Turkey. It prefers human settlements such as buildings and farms. The natural habitat of the species usually consists of rock faces, caves and birds' nesting cliffs. It usually feeds cereals, but some invertebrates can also (Baptista, 1997). The highest population of this species was recorded in old buildings; the lowest population was recorded in parks in Islamabad. The pigeon population is predominantly concentrated in old buildings (Ali et al., 2013). This species is dominant in Ankara and Kayseri. Since the urbanization is increasing very intensively in both provinces, apartment balconies are important nesting areas for the rock dove. In industrialized provinces, urbanization and housing are increasing, while the rock dove population and distribution are expanding.

Corvidae can successfully adapt to human presence (Matsyura, 2015). The hooded crow population trend shows the moderate increase. The Eurasian magpie is stable and the Eurasian jackdaw shows the moderate decline in Europe (Gregory et al., 2007). There is no research about population trends in Turkey. City centers and settlements are especially important for the common species because they can find particularly easy food there. The Eurasian magpie, the hooded crow, and the Eurasian jackdaw are very competitive and common species in city centers. The crows enter the competition with songbird species. In provinces where crows are very common, small songbirds are less common. Especially, it is the predator for the offspring in Turkey.

The Eurasian magpie is a common bird in many parts of Palearctic and in parts of Western America (Birkhead, 1991). In the last 50 years, the magpie showed colonization many cities in Palearctic towns and shows dramatic population growth in urban and suburban areas. This population growth has proceeded eastward in the Palearctic with some exceptions. It has ecological tolerance to succeed in the urban environment (Jerzak, 2001). The distribution of this species in these provinces has increased within years in Turkey based on this research.

Citizen scientists today are playing active roles in a variety of ecological projects. Their contributions enable scientists to collect large amounts of data at low cost. Bird watching is popular among the people. As urban areas expand and scientists work to find ways of managing wildlife in cities, data collect is needed about the relationships between animals and urban areas. Citizen science-based studies may play an important role in collecting information in urban areas (Mccaffrey, 2005). KuşBank is the first Citizen Science Project in Turkey. The data quality and the number of observations of citizens are increasing day by day in Turkey. eBird Turkey (e-KuşBank) is an important tool that contributes to nature conservation and species monitoring. Trakuş is the other tool that contributes to the monitoring of bird species through photos and observations in Turkey. e-KuşBank is the most comprehensive database. In addition, Trakuş observations were also evaluated to check data.

The bird observation database is established from different bird databases, reports, some thesis, and articles, but the rate of data obtained from thesis and articles is low in this database. Because observation dates and number of individuals in articles and thesis are not as easy and clear as to be transferred to the database. There are also, many kinds of research that focus only on the biology of species. Most of the avifaunistic studies have been prepared with checklists but the dates of observation are not given in detail.

The status of common birds is first time described with this study in the most developed and industrialized provinces of Turkey. These provinces have very different geographical features, habitats, industrialization and urbanization levels. The common birds and species composition are different in every province. Human influence is dominant in these provinces. The habitats of people and the habitats of birds are intertwined. Those birds that provide good adaptation to these areas are becoming more dominant and common. In the near future, it is expected that there will be new changes in the composition, distribution, and dominance of common species due to the increase of industrialization and urbanization in Turkey.

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